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Authors **Marcello Picollo, Andrea Casini, Costanza Cucci, Marina Ginanni, Elena Prandi, Magnolia Scudieri, Tatiana Vitorino**

Title ***The use of hyper-spectral imaging technique to reveal concealed layers: a key question for the study of paintings***

Abstract

Hyper-spectral imaging, based on a high performance scanner operating at both high spectral and spatial resolution in the visible (Vis) and near-infrared (NIR) regions, has been applied as an *in situ* technique for the study and digital documentation of cultural heritage. When paintings are concerned, hyper-spectral imaging application in the NIR range is particularly important to provide essential information about the artworks' construction to museums professionals, conservators, and art historians. Paintings are frequently composed by different complex layers and those below the surface are usually invisible to the naked eye. Among these layers are the underdrawings that were generally created by the artists with different techniques and materials, typically charcoal and chalk, metalpoints, and inks. Since some of them absorb the NIR radiation it is possible to unveil and study what may be present under the visible coloured layers. However, the visualisation of these drawings may depend on the transparency of the coloured paint layers. Moreover a high spatial resolution is generally required in order to allow the discrimination between the multiple lines of the underdrawings. As such, the possibility to reconstruct highly resolved images at different wavelengths, which allows to go further into the different layers and obtain a higher degree of visualisation, is of great advantage. In this context, understanding which is the minimum spatial and spectral resolution needed for the spectral imaging systems to provide useful and accurate in-depth information is one of the questions addressed by COSCH Working Group 1 (WG1) and which will be discussed in the present work. Within an interdisciplinary collaboration between the WG1 community, museum professionals, conservation scientists, and technology specialists, a painted wood panel reconstructed according to a medieval technique described by Cennino Cennini was prepared and analysed with a push-broom hyper-spectral imaging scanner in the NIR range. On top of the panel's preparation layer, various lines and drawings were created with different materials (lead-based metalpoint, lead- and tin-based metalpoint, graphite, charcoal, and watercolour), which were then hidden by the coloured paint layers applied above. These underdrawings were used to assess the actual performances of the hyper-spectral imaging system and to evaluate its ability to discriminate between the patterns of lines underneath layers of variable thickness and diverse chemical composition.

Authors **Jonathan Roy Gration, Douglas Alexander Cawthorne**

Title ***Hidden but not lost; Exploring the Great Hall at Boughton House***

Abstract

This paper describes preliminary doctoral research on the creation of high resolution, textured digital reconstructions and novel visualisations of several historical phases of the Great Hall of Boughton House in England.

Boughton House (1538-1910) is a sprawling country house built around 7 courtyards with twelve entrances, 52 chimney stacks and 365 windows. Its nickname "The English Versailles" is understandable. The focus of this paper is the Great Hall, which has been the central space of the house since its first establishment as a manor house on this site. The most eye catching

SESSION 6D

COLOUR AND SPACE IN CULTURAL HERITAGE: INTERDISCIPLINARY CONNECTIONS

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element of the Great Hall is undoubtedly the wonderfully painted ceiling by Louis Chéron of 1705 depicting the Apotheosis of Hercules. The wainscoting panels appear to be of the same date, but are in fact additions of a restoration campaign in 1911. The panelling replaced a series of Corinthian pilasters of the same period as the painting by Chéron. The painted barrel vaulted ceiling however hides an earlier phase of this space, the Tudor Great Hall. The Tudor ceiling with its carved wind braces and quatrefoil patterns is still in a remarkable state of preservation although hidden behind its painted plaster successor. An original doorway dating to this period has also remained in situ. In addition there exist detailed inventories of furnishings many of which can be traced and there is also a valuable art collection which adorned the space and is still retained by the family.

Using these sources and a conservation level examination of the extant fabric including laser scanning, photogrammetry and HDR texture capturing it is possible to reconstruct the earlier phases of the architectural features of the Great Hall, its contents and furnishings. The paper examines the challenges of doing so, the creation of digital reconstructions of the phases in the history of the Great Hall and issues of diminishing levels of certainty achievable the further back in time one goes. It also examines comparisons of various forms of evidence that inform and influence the end result. The need to exercise balanced evaluation is examined when combining physical evidence and remains, such as tangible objects and textures that are preserved in situ and elements of which only intangible archival evidence remains. In order to create authenticated and trusted 3D digital reconstructions, particular research methodologies from the digital humanities have been combined with the practice based methodology of heritage conservation and restoration. Applying the rigorous standards of physical conservation and restoration to digital reconstructions is presented as a quality control measure that ensures all elements of the reconstructed 3D models can be authenticated, avoiding the temptation of modelling for effect instead of fact.

This ongoing project is presented as a specific example of the work that the Digital Building Heritage Group at De Montfort University undertakes, making the past of architectural heritage accessible through the creation of engaging digital reconstructions based on thorough academic research.